

UCRL- 84883 SUMMARY  
PREPRINT

The Effect of Non-Heterogeneous Wetwell  
Boundaries on Pressure Suppression  
System Response

E. W. McCauley and G. S. Holman  
Lawrence Livermore National Laboratory  
Livermore, California U.S.A.

K. Namatame, Y. Kukita, and M. Shiba  
Japan Atomic Energy Research Institute  
Tokai-Mura, Japan

This paper was prepared for submittal to the  
6th International Conference on Structural  
Mechanics in Reactor Technology  
Paris, France, August 17-21, 1981

August 29, 1980

This is a preprint of a paper intended for publication in a journal or proceedings. Since changes may be made before publication, this preprint is made available with the understanding that it will not be cited or reproduced without the permission of the author.

CIRCULATION COPY  
SUBJECT TO RECALL  
IN TWO WEEKS

Lawrence  
Livermore  
Laboratory

The Effect of Non-Heterogeneous Wetwell Boundaries on  
Pressure Suppression System Response\*

E. W. McCauley and G. S. Holman

University of California  
Lawrence Livermore National Laboratory  
P. O. Box 808, L-140  
Livermore, California 94550

K. Namatame  
Y. Kukita  
M. Shiba

Japan Atomic Energy Research Institute  
Tokai-Mura, Japan

SUMMARY

The Full-Scale Mark II CRT (Containment Response Test) Program is in progress at the Tokai-Mura Establishment of the Japan Atomic Energy Research Institute (JAERI). The primary objective of the on-going CRT Program is to provide a data base for evaluation of the pressure suppression pool (wetwell) hydrodynamic loads associated with a postulated loss-of-coolant accident (LOCA) in the BWR Mark II containment system. The test facility is 1/18 of full scale in volume and has a wetwell which is a full-scale geometric replica of one 20°-sector of a reference 1100MWe Mark II as shown in Figure 1. As such, it is unique in offering the opportunity to determine prototypical pressure suppression system response to the LOCA. Through a technical liaison established in 1979, the Lawrence Livermore National Laboratory is working closely with the CRT Program Staff to provide data evaluation useful to both the U.S. NRC and JAERI which aids activities related to advanced code development and the safe operation of Boiling Water Reactors (BWR) using the Mark II containment design.

---

\* This work was supported by the United States Nuclear Regulatory Commission under a Memorandum of Understanding with the United States Department of Energy.

The usefulness of pressure measurements obtained from CRT is dependent on the degree to which the test facility wetwell boundary response can be related to that in the prototype plant wetwell. As shown in Figure 2, the CRT wetwell boundaries are heterogenous consisting of essentially rigid side walls, flexible end walls, and a partially flexible floor. Prototype plant wetwells in Japan and the United States, for which pool load definition is required, are of two types: steel lined concrete (essentially rigid) and steel shells.

A systematic analytical study is underway, with particular focus on the LOCA induced chugging phenomenon, to provide a qualitative understanding of the possible fluid-structure interaction (FSI) effects on pressures measured in the CRT wetwell. Significant modification of an impulsively delivered pressure pulse can occur at a boundary point due to relative flexibility of that boundary as well as to the influence of adjacent boundaries of either greater or lesser flexibility. The analyses, done in a two-dimensional plane geometry, compare the extreme case, offered by the wetwell boundaries modelled as completely rigid, to two cases which model the wetwell floor flexibility as a continuous shell and as a periodic and segmented plate structure representative of the actual CRT wetwell floor. As shown in Fig. 3, three arrangements of vent pipes are considered. They vary from the single vent pipe simultaneously exposed to both rigid and flexible side boundaries, to two vent pipes exposed to rigid interior walls, to three vent pipes exposed to rigid side boundaries but flexible end walls.



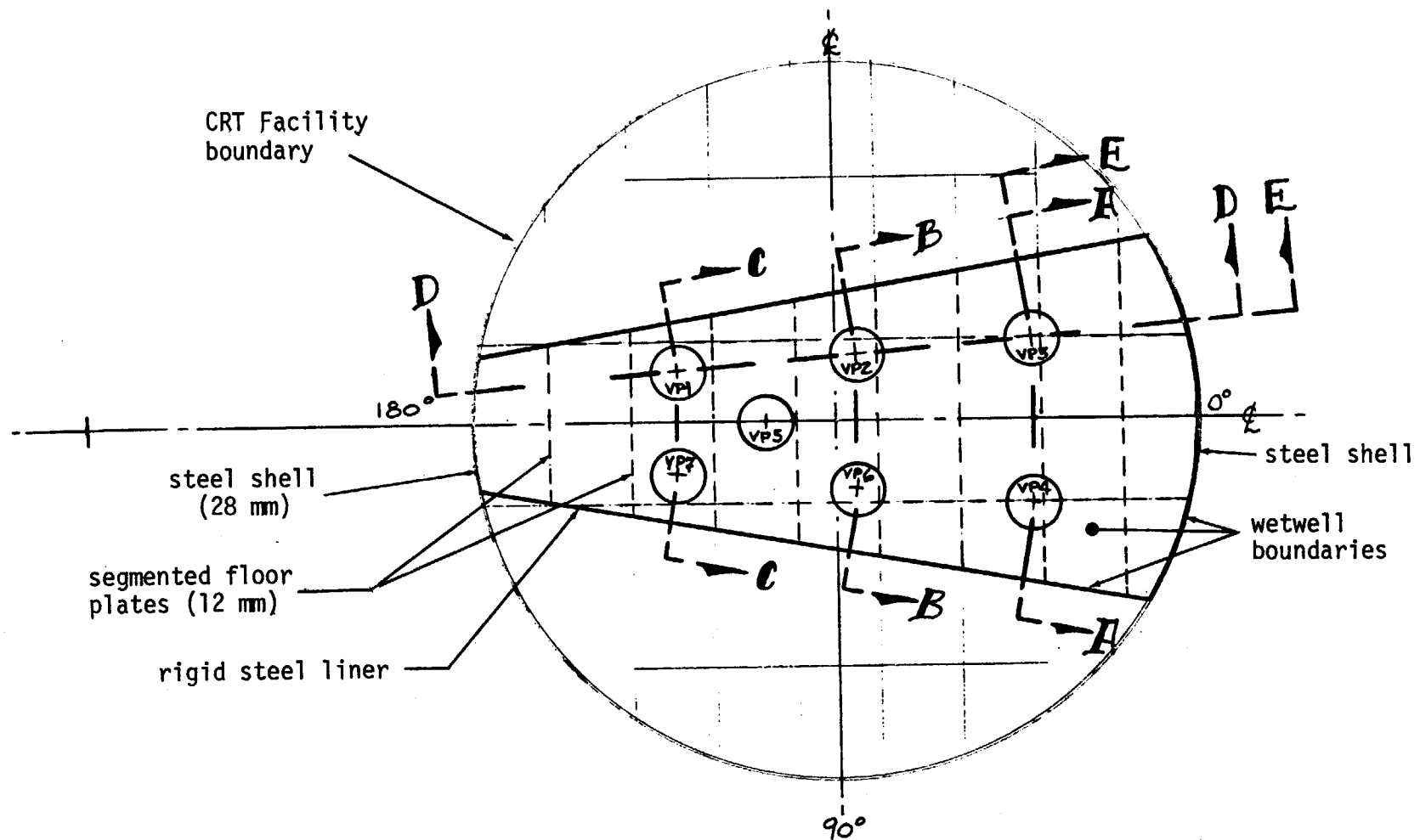


Fig. 2. CRT Wetwell Boundaries - Plan View

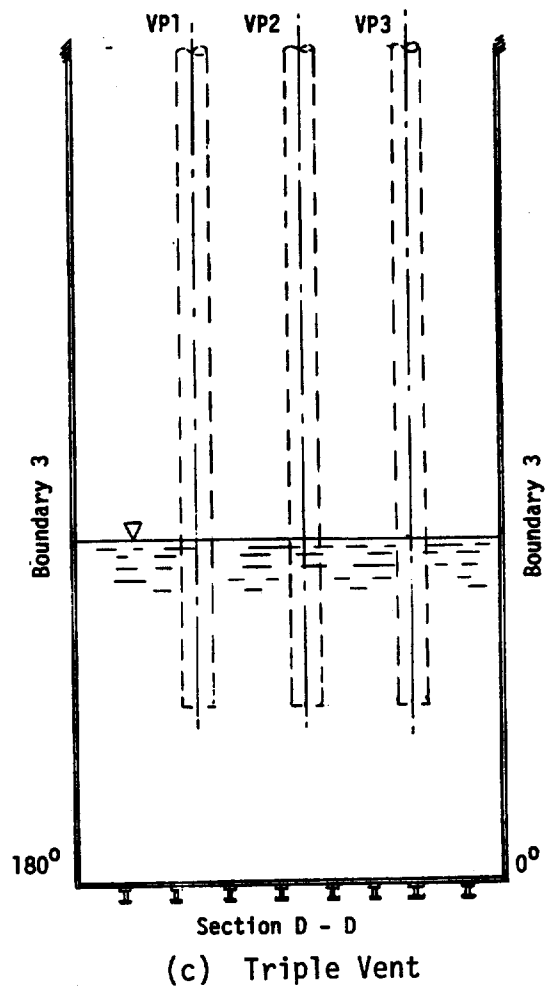
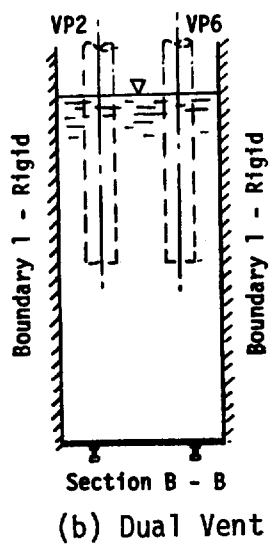
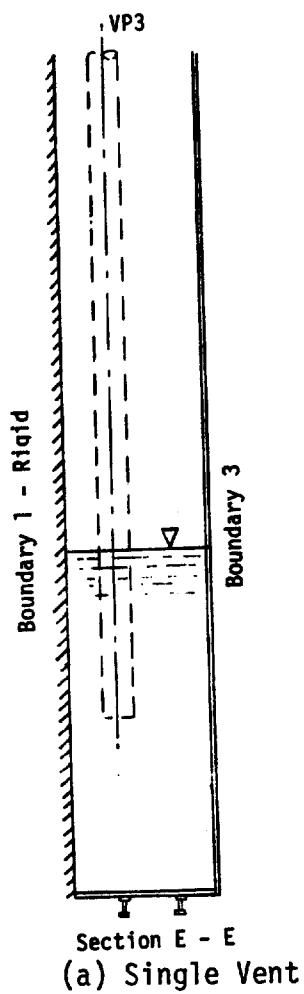


Fig. 3. Geometry of the Wetwell Analyses

Recent work has suggested that the chugging process is initiated by a rapid condensation (rarefaction) occurring near the vent pipe exit. The chug event is characterized by a strong but damped pressure oscillation which exhibits the facility dependent wetwell frequency; this can be preceded by a non-damped pressure oscillation with the acoustic frequency of the vent pipe. The source used in this analytical study is thus taken as a facility-independent negative pressure ramp at the vent pipe exit. As expected, it produces a characteristic positive dynamic pressure response at the wetwell boundary. The purpose of this proposed paper is to discuss the results of the above described ongoing analysis.

